PROTECTIVE IRRIGATION WORKS

RAJPUTANA.

SANDERO PROJECT

TONK PARGANAH

TONK STATE.

1906.

AJMER:
SCOTTISH MISSION INDUSTRIES CO., LTD.

1906.

INDEX.

SANDERO PROJECT, TONK PARGANAH TONK STATE.

References.—Para. 17 and Appendix E of Report on Irrigation in the Tonk State.

REPORT.

Project described.

Sandero is a khalsa village, about 14 miles north-west of Tonk, on the left bank of a nullah which rises in the Lawa Estate and enters Tonk territory six miles north-west of Sandero.

A site for a Storage Reservoir was pointed out to us at Haripura, three miles above Sandero, and for this Surveys have been prepared and separate Plans and Estimate worked out. If constructed the Haripura Project will interfere with that at Sandero, as it will cut off 12 square miles of the catchment; but both are submitted, and the Durbar must decide which it considers will bring most advantage to the Parganah.

Above Sandero village the river bed for about half a mile is a series of ledges of hard rock, and there is an excellent site on the ledge furthest up stream, and about a $\frac{1}{4}$ mile above the village, for constructing a Weir, with an earthen Dam on either side to prevent flood water spilling, and this water could then be taken by a channel on the left bank to supply a new tank which would be formed below Sandero. This tank would be constructed partly for bed cultivation, and partly to irrigate some 250 acres of khalsa land, below, and between it and the left bank of the nullah. After filling this new tank any spare water would pass into an existing Nadi belonging to the Piplo Jaghir, and from that again into the Piplo tank (see Plan No. 1); so that practically all the water available in the rains, passing down the nullah, could be diverted to benefit land on the left bank.

Catchment Area and Water available for Storage.

2. Including Haripura, there is a total catchment area of 21 square miles available, as the water from the tributary nullahs in the Lawa Estate is all intercepted; and from this a run-off of 10 per cent. of the average rainfall of 18½ inches should be available for storage, or 90·6 m.c.ft.

Crest Level of Weir.

3. Taking R. L. 100 as the bed level of the nullah at the site of the Weir, it is proposed to make crest level R. L. 115, and the supply channel will start at bed level R. L. 110, and will be taken in cutting with a fall of two ft. per mile at first, and then one ft. per mile till it reaches the ground surface at R. L. 108, and this will be the Weir level of the Tank which it is proposed to construct to store the water diverted.

Water-spread and Capacity of New Tank.

4. The tank will have the following water-spread and capacity :—

R. L.	Water-spread in s.ft.	Capacity between each Contour in m.c.ft.	Capacity below each Contour in m.c.ft.
108	9,640,000	31·76	53·52
104	6,400,000	18·64	21·76
100	3,120,000	3·12	3·12
97	Bed level		

5. Assuming that the nullah will run for four days during the rains, the Feeder Channel must discharge the 53·62 m.c.ft. required in this time, or—

$$D = \frac{53{,}520.000}{4 \times 24 \times 60 \times 60} = 154{\cdot}8 \text{ cusecs.}$$

The channel has a total length of 6,730 r.ft. For the first 730 ft. from the nullah bed to head works it has a level bed; from chainage 730 to 4,730, where it has a fall of 2 ft. per mile, the section required is $8\frac{1}{2}$ ft. bed width, 5 ft. depth and side slopes of 1 to 1.

From chainage 4,730 to 6,730, with a fall of 1 ft. per mile, the section required is 14 ft. bed width, $4\frac{3}{4}$ ft. depth, and side slopes of 1 to 1.

Maximum Discharge and Length of Weir.

6. The maximum discharge from the catchment of 21 square miles is 8,185 cusecs; and to discharge this, less the 155 cusecs passing down the supply channel, with a 2-ft. head, a Weir 805 r.ft. in length is required.

Head Works.

7. The Weir will be of masonry, built on the rocky ledge, into which the founds will be countersunk: width at crest (R. L. 115) will be 3 ft.; front batter 1 in 12; and the thickness at any point $T = \frac{d}{\sqrt{g}}$ where "d" is the depth below flood level, and "g" the specific gravity of masonry = 2·24.

On either bank masonry Wing-walls will be built, with Core-walls for 50 ft. in length taken into the earthen Dams, which will be carried round till ground surface at R. L. 120 is reached, to prevent the water spilling away on either side. These Dams will be 8 ft. wide at top (R. L. 120), and have front and rear slopes of 3 to 1 and 2 to 1 respectively.

The water held up by the Weir will be:—

R. L.	Water-spread in s.ft.	Capacity between each Contour in m.c.ft.	Capacity below each Contour in m.c ft.
115 (Crest level)	2,720,000	9·31	13·22
110 (Bed level of channel)	1,120,000	3·38	3·91
105	3,20,000	·53	·53
100	Bed level of Nullah		

At 400 ft. from the north end of the Weir on the left bank, the supply channel passes through the earthen dam, wing-walls of masonry being provided with a cross-wall with arched opening $\overset{\text{B.}}{3} \times \overset{\text{H.}}{5}$, over which a gate with counterweights, to facilitate raising, is fixed, to regulate the supply down the channel. This gate when full open, and water is at crest level of Weir, will discharge 163 cusecs.

Storage Tank.

8. The earth embankment of the Storage Tank is 8,420 r.ft. in length, the level at crest is R. L. 113 or 5 ft. above Weir, top width 8 ft., and front and rear slopes 3 to 1 and 2 to 1 respectively.

The greatest depth of water held up is 11 ft., and the water-spread at Weir level (R. L. 108) is 9,640,000 s.ft. or 221 acres. After this Tank is full, if the nullah is still running, water can be passed on to an existing Nadi belonging to Piplo, and from it to the Piplo Tank, guide Dams being constructed to connect this chain of Tanks (see Plan No. 1). The land commanded by the Tank is 260 acres, and to irrigate this 26 m.c.ft. of water are required; so that 27 m.c.ft. of the 53 m.c.ft. stored in the tank must be let out through the Sluices to allow the land in the bed to be cultivated, after it has become saturated.

Sluices.

9. Two Sluices are provided, and they must be capable of discharging this 27 m.c.ft. of water in the month before the irrigation season commences; the land submerged at the higher level of the bed of the tank will then be available for cultivation, and the Sluices can discharge the remaining water stored to irrigate the land commanded below. The Sluices must therefore discharge—

$$D = \frac{27{,}000{,}000}{30 \times 24 \times 60 \times 60} = 10{\cdot}4 \text{ cusecs; or } 5{\cdot}2 \text{ cusecs through each}$$

Sluice.

If 27 m.c.ft. is discharged from the Tank in 1 month, the water level will have fallen to R. L. 105, and the Sluices will have been discharging this quantity with a mean head of 8·5 ft., and with this head a 9-inch diameter Sluice can discharge 7·97 cusecs, so satisfies requirements.

Design for Sluices.

10. The Sluices are similar in design to those provided in other projects for the Tonk State, and consist of a circular masonry Sluice-well, in which the Sluice pipe is fixed, with Core-walls on either side to prevent the water creeping through the embankment. The Wing-walls form an outer chamber, before they splay out, and have cut grooves into which planks can be placed when it is required to shut off the water from the Sluice well to examine or repair the Sluice valve. An iron grating with vertical bars is also provided to prevent brushwood or anything likely to injure the valve passing into the well. The water passes from the Sluice pipe into an arched masonry drain under the rear slope of the embankment to the irrigation channels.

Irrigation Channels.

11. To discharge 10·4 cusecs, the maximum required, the channels with a fall of 2 ft. per mile will have a section of 3 ft. bed width, depth of 2 ft., and side slopes of 1 to 1. These have not been set out, as they can be made as required by the villagers.

Materials. 12. Stone for building; kunkar for lime; and wood for fuel are available near Sandero.

Abstract Estimate of Cost. 13. The Abstract Estimate of the cost of the Project is:—

		Rs.	Rs.
(1) Head Works—			
	Earthen Embankments	1,360	
	Weir with Wing-walls, etc., ...	11,584	
	Regulating Gate	734	
			13,678
(2) Supply Channel			1,802
(3) Storage Tank—			
	Embankment		21,658
	Sluices		3,554
	Irrigation Channel		100
(4) Contingencies			2,040
	Total Rs.		42,832

Revenue. 14. The Revenue to be realized will be from half the bed area of the storage tank, or say 100 acres; and from 260 acres irrigated below, at Rs. 4 per acre = 1,440 Rs., giving a profit of over $3\frac{1}{4}$ per cent. on the estimated cost of the proposed work.

This does not take into account the value of water that may be passed on to the Jagirdar of Piplo.

Preparation of Project. 15. The Surveys, Plans and Estimate have been prepared by Overseer Mannu Lal, under the directions of the Superintending Engineer, Protective Irrigation Works, Rajputana.

SPECIFICATION.

Dimensions. 16. All dimensions and measurements of the work are given in the Plans and Estimate, and are to be strictly adhered to.

Marking out. 17. The centre line and side slopes of supply channel and earthen Dams to be marked out with trenches 1 ft. broad and 9 inches deep, showing permanently the inner and outer slopes and the breadth of the top of embankment.

Earthwork. 18. The embankment to be carried out in layers not exceeding 9 inches in thickness, carefully consolidated. All the layers will be laid concave, that is lower in the centre. No clods of earth should on any account be allowed in the embankment. No earth to be excavated within 100 ft. of toe of either slope.

Supply Channel. 19. All the cutting to be done as per section with required slope in bed.

Masonry. 20. The masonry of Weir, Core-walls, Sluices, etc., to be of rubble stone set in lime mortar; only hard and durable stones to be used, and the masonry to be kept wet during construction. All the stones to be hammer-dressed and to break joint in the same as well as in the successive courses.

All stones are to be laid on their natural beds; where there is batter the beds of the stones are to be filled in with smaller ones completely embedded in mortar. No empty hollow to be left, nor spaces filled wholly with mortar or rubbish where pieces of stones ought to have been inserted. The faces of the masonry in contact with the earth to be left quite rough, and those remaining exposed to be smoothed and pointed with lime mortar.

21. The lime to be of good hard kunkar burnt in wood fuel. The mortar to consist of one part lime to $1\frac{1}{2}$ parts clear sand or surkee. **Lime Mortar.**

F. ST.-G. MANNERS SMITH,
SUPERINTENDING ENGINEER,
Protective Irrigation Works, Rajputana.

AJMER,
12th February 1906.

ABSTRACT ESTIMATE OF COST.

Sandero Project, Tonk Parganah—Tonk State.

Quantity or Number.	Items.	Rate.	Per	Amount.	Total.
		Rs. A.		Rs.	Rs.
	(1) HEAD WORKS.				
	(*a*) Earthen Embankment.				
271,949 c.ft.	Earthwork	5 0	1,000 c.ft.	1,360	
					1,360
	(*b*) Weir with Wing and Core-walls.				
14,659 c.ft.	Excavation	5 0	1,000 c.ft.	73	
12,564 ,,	Rock-cutting	2 0	100 ,,	251	
67,092 ,,	Masonry	16 0	100 ,,	10,734	
8,780 ,,	Pitching	3 0	100 ,,	263	
3,292 ,,	Concrete blocks	8 0	100 ,,	263	
					11,584
	(*c*) Regulating Gate.				
3,932 c.ft.	Excavation	5 0	1,000 c.ft.	20	
387 ,,	Rock-cutting	2 0	100 ,,	8	
16 ,,	Concrete	10 0	100 ,,	2	
3,491 ,,	Masonry	16 0	100 ,,	559	
,,	Arch Masonry	20 0	100 ,,	1	
818 ,,	Pitching	3 0	100 ,,	25	
7 ,,	Stone Wall	2 0	c.ft.	14	
8 s.ft.	2-inch Slab	0 8	s.ft.	4	
2 Nos.	Stone Weight Blocks ...	2 0	each	4	
19 s.ft.	Gate complete	2 0	s.ft.	38	
1 No.	Pulley, with stand complete	5 0	each	5	
16 r.ft.	Chain with hooks	2 0	r.ft.	32	
12 ,,	Rails, metre-gauge $3\frac{3}{8}''$ ...	1 0	,,	12	
5 ,,	H. Iron, $3'' \times 2''$	1 0	,,	5	
12 ,,	Rod Iron, $1\frac{1}{4}''$ diameter ...	0 6	,,	5	734
	Carry forward ...	...	.....	.....	13,678

Quantity or Number.	Items.	Rate.	Per	Amount.	Total.
		Rs. A.		Rs.	Rs.
	Brought forward ...	...	.....	.....	13,678
	(2) SUPPLY CHANNEL.				
450,498 c.ft.	Excavation	4 0	1,000 c.ft.	1.802	1,802
	(3) STORAGE TANK.				
4,331,604 c.ft.	(*a*) Earthwork	5 0	1,000 c.ft.	21,658	21,658
	(*b*) SLUICE No. 1.				
5,782 c.ft.	Excavation	5 0	1,000 c.ft.	29	
2,018 „	Concrete	10 0	100 „	202	
5,658 „	Masonry	16 0	100 „	912	
259 „	Arch Masonry	20 0	100 „	52	
231 s.ft.	2-inch Slab	0 8	s.ft.	116	
3 Nos.	Stone Brackets	2 0	each	6	
28 c.ft.	Woodwork	3 0	c ft.	84	
56 s.ft.	Iron Grating with vertical bars	1 0	s.ft.	56	
80 r.ft.	Rod Iron, 1″ diameter ...	0 4	r.ft.	20	
1 No.	Sluice Pipe, 9″ diameter ...	300 0	each	300	1,777
	(*c*) SLUICE No. 2.				
	Same as Sluice No. 1 ...	...	.....	...	1,777
	(*d*) IRRIGATION CHANNEL.				
25,000 c.ft.	Excavation	4 0	1,000 c.ft	100	100
	Total ...		.....	... Rs.	40,792
	Contingencies ...	5 0	per cent.	...	2,040
	GRAND TOTAL	...	.....	... Rs.	42,832